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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/657,842	09/09/2003	Yukihisa Takeuchi	791_228	2130
25191	7590	07/12/2005	EXAMINER	
Burr & Brown PO BOX 7068 SYRACUSE, NY 13261-7068			DO, AN H	
			ART UNIT	PAPER NUMBER
			2853	
DATE MAILED: 07/12/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/657,842

Applicant(s)

TAKEUCHI ET AL.

Examiner

An H. Do

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 31 May 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 8-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 3 and 13-31 is/are allowed.
- 6) ☒ Claim(s) 1,2,4-6 and 8-12 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 5/31/05.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### **DETAILED ACTION**

The RCE filed on 31 May 2005 has been acknowledged.

#### ***Information Disclosure Statement***

1. The information disclosure statement (IDS) submitted on 31 May 2005 was filed and is being considered by the examiner.

#### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 2, 6, 8, 9 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaida (US 6,174,051) in view of Takeuchi et al (US 5,767,612).

Sakaida discloses in Figures 4 and 5 the following claimed features:

Regarding claim 1, a piezoelectric/electrostrictive film type actuator (piezoelectric element 33) comprising a substrate (cavity plate 32) having a cavity (31) formed in an internal portion thereof; and a piezoelectric/electrostrictive device (piezoelectric layers 33A-33C, 34 and 40) disposed on one surface (top surface) of the substrate (cavity plate 32), and including a plurality of piezoelectric/electrostrictive films (piezoelectric element 33) and electrode films (36); wherein piezoelectric/electrostrictive films (piezoelectric layers 33A-33C) and the electrode films (36) are alternately laminated such that the electrode films (36) form uppermost (electrode 36 above layer 33A) and lowermost layers (electrode 36 below layer 33C) of the piezoelectric/electrostrictive

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device (Figures 4 and 5, piezoelectric element 33); and wherein the actuator (piezoelectric element 33) is driven by displacement of the piezoelectric/electrostrictive device (Figures 4 and 5, layers 33A-33C) such that said uppermost electrode film (electrode 36 above layer 33A) moves (Figure 5) and the cavity (31) is pressurized by deforming a part of a wall thereof (Figure 5, layer 40 is part of a wall of cavity 31) with the piezoelectric/electrostrictive device (Figures 4 and 5, piezoelectric element 33).

Regarding claim 2, wherein the piezoelectric/electrostrictive device includes two to four layers of the piezoelectric/electrostrictive films (Figures 4 and 5 show three layers 33A-33C).

Regarding claim 6, comprising two or more of the piezoelectric/electrostrictive devices disposed on the substrate (cavity plate 32) (Figure 5 shows at least two piezoelectric elements 33).

Regarding claim 12, an ink pump of a printer disposed in an inkjet printer comprising the piezoelectric/electrostrictive film type actuator (Figure 4, piezoelectric element 33).

Sakaida discloses the claimed invention except for reciting the following claimed features:

Further regarding claim 1, a ceramic substrate having a plurality of laminated thin plate layers.

Regarding claim 8, wherein the ceramic substrate comprises two or three laminated plate layers.

Regarding claim 9, wherein a thickness of a thinner portion of the ceramic substrate is 50  $\mu\text{m}$  or less.

Takeuchi et al teach the following claimed features:

Further regarding claim 1, a ceramic substrate (Figures 13 and 14, element 22) having a plurality of laminated thin plate layers (diaphragm plate 26, connecting plate 28, spacer plate 30, column 18, lines 60-64).

Regarding claim 8, wherein the ceramic substrate (Figures 13 and 14, element 22) comprises two or three laminated plate layers (diaphragm plate 26, connecting plate 28, spacer plate 30, column 18, lines 60-64).

Regarding claim 9, wherein a thickness of a thinner portion of the ceramic substrate (22) is 50  $\mu\text{m}$  or less (column 5, lines 13-15).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to include a multi-layered ceramic substrate, as taught by Takeuchi et al into Sakaida, for the purpose of obtaining an integral laminar structure.

4. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaida (US 6,174,051) in view of Nishimura et al (US 6,437,484).

Sakaida discloses the claimed invention except for reciting the following claimed features:

Regarding claim 4, wherein a per layer thickness of the piezoelectric/electrostrictive films is 30  $\mu\text{m}$  or less.

Regarding claim 5, wherein at least one layer of the piezoelectric/electrostrictive films is formed by electrophoresis deposition.

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Nishimura et al teach the following claimed features:

Regarding claim 4, wherein a per layer thickness of the piezoelectric/electrostrictive films is 30  $\mu\text{m}$  or less (column 9, lines 26-32).

Regarding claim 5, wherein at least one layer of the piezoelectric/electrostrictive films is formed by electrophoresis deposition (column 10, lines 8-18).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to include a per layer thickness of the piezoelectric/electrostrictive films is 30  $\mu\text{m}$  or less; and at least one layer of the piezoelectric/electrostrictive films is formed by electrophoresis deposition, as taught by Nishimura et al into Sakaida, for the purpose of obtaining large electro-mechanical coupling coefficient.

5. Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaida (US 6,174,051) in view of Takeuchi et al (US 5,376,857).

Sakaida discloses the claimed invention except for reciting the following claimed features:

Regarding claim 10, wherein the ceramic substrate is formed of a material containing any of zirconium oxide, aluminum oxide, magnesium oxide, aluminum nitride, and silicon nitride as a major component.

Regarding claim 11, wherein the ceramic substrate is formed of a material containing either stabilized zirconium oxide or completely stabilized zirconium oxide which is a major component.

Takeuchi et al teach the following claimed features:

Regarding claim 10, wherein the ceramic substrate is formed of a material containing any of zirconium oxide, aluminum oxide, magnesium oxide, aluminum nitride, and silicon nitride as a major component (column 3, lines 6-11).

Regarding claim 11, wherein the ceramic substrate is formed of a material containing either stabilized zirconium oxide or completely stabilized zirconium oxide which is a major component (column 3, lines 6-11).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to include the ceramic substrate formed of a material containing any of zirconium oxide, aluminum oxide, magnesium oxide, aluminum nitride, and silicon nitride as a major component, as taught by Takeuchi et al into Sakaida, for the purpose of having a low reactivity with the piezoelectric material (column 3, lines 3-5).

### ***Response to Arguments***

6. Applicant's arguments, see Applicant's Remarks, filed 31 May 2005, with respect to the rejection(s) of claim(s) 1, 2, 4-6 and 8-12 under 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Sakaida (US 6,174,051). Sakaida discloses an inkjet head having a piezoelectric element in which an uppermost electrode film moves upon activation of the actuator.

### ***Allowable Subject Matter***

7. Claims 3 and 13-31 are allowed.

The following is an examiner's statement of reasons for allowance:

The primary reason for the allowance of claim 3 is the inclusion of the limitation of a piezoelectric/electrostrictive film type actuator that includes a plurality of piezoelectric/electrostrictive films wherein a thickness  $t_n$  of an n-th piezoelectric/electrostrictive film from the bottom of the piezoelectric/electrostrictive device satisfies the following equation:  $t_n \leq t_{n-1} \times 0.95$ . It is this limitation found in the claims, as it is claimed in the combination of, that has not been found, taught or suggested by the prior art of record which makes these claims allowable over the prior art.

The primary reason for the allowance of claims 13, 15-21 and 23-31 is the inclusion of the method of manufacturing a piezoelectric/electrostrictive film type actuator that includes a step of sintering the piezoelectric/electrostrictive films and/or the electrode films a predetermined number of times at arbitrary times between the step of forming the electrode film (A) and the step of forming the electrode film (C). It is this step found in the claims, as it is claimed in the combination of, that has not been found, taught or suggested by the prior art of record which makes these claims allowable over the prior art.

The primary reason for the allowance of claims 14 and 22 is the inclusion of the method of manufacturing a piezoelectric/electrostrictive film type actuator that includes a step of sintering the piezoelectric/electrostrictive films and/or the electrode films a predetermined number of times at arbitrary times between the step of forming the electrode film (A) and the step of forming the electrode film (C); wherein a thickness  $t_n$  of an n-th piezoelectric/electrostrictive film from the bottom of the



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piezoelectric/electrostrictive device satisfies the following equation:  $t_n \leq t_{n-1} \times 0.95$ . It is this step found in the claims, as it is claimed in the combination of, that has not been found, taught or suggested by the prior art of record which makes these claims allowable over the prior art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yun et al (US 6,347,441) disclose a manufacturing method for forming a multi-layered piezoelectric/electrostrictive ceramic actuator by sintering process at low temperature (Abstract).

#### ***Contact Information***

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to An H. Do whose telephone number is 571-272-2143. The examiner can normally be reached on Monday-Friday (Flexible).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen D. Meier can be reached on 571-272-2149. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'An H. Do', with a long horizontal flourish extending to the right.

An H. Do  
July 6, 2005